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APPARATUS AND METHODS FOR MANAGEMENT OF TEMPORAL PARAMETERS TO PROVIDE ENHANCED ACCESSIBILITY TO COMPUTER PROGRAMS

5   ## 1. Technical Field:

The present invention is directed to an improved network computer system. More particularly, the present invention provides apparatus and methods for management of temporal parameters to provide enhanced accessibility

10   to computer programs.

2. Description of Related Art:

There has been much emphasis recently in designing computer programs such that the computer programs are

15   more accessible to handicapped or disabled persons. Such efforts to accommodate handicapped persons have been mostly focused on the visual and aural domains. That is, the computer programs are provided with options for changing visual and audio output parameters to make the

20   computer program interface more accessible by the handicapped person.

For example, efforts have been made to allow for enlarging the size and changing the type of fonts used by Internet browser applications and changing the color of

25   the fonts used. In addition, web reader software applications have been devised for reading the content of a downloaded web page to a visually impaired user.

The prior art efforts have not addressed the temporal parameters of computer programs. That is,

30   senior citizens or persons who are cognitively disabled, for example, may be able to see and hear the content of a web page but may require more time to interpret the

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visual and audio information from the web page. Thus, it would be beneficial to have apparatus and methods for managing temporal parameters of computer programs to provide greater accessibility to disabled persons.

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SUMMARY OF THE INVENTION

The present invention provides apparatus and methods for managing temporal parameters of computer programs to

5   enhance the accessibility of the computer programs to disabled persons. The apparatus and methods of the present invention provide a mechanism by which computer program data is analyzed to determine the presence of predefined temporal parameters. When the predefined

10   temporal parameters are encountered during the analysis, the values for the temporal parameters are modified based on a user profile. The modified temporal parameters provide a different temporal output for the computer program data from that of the original computer program

15   data. In this way, the temporal output of the computer program data is adjusted to take into consideration the cognitive disabilities of the user.

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BRIEF DESCRIPTION OF THE DRAWINGS

The novel features believed characteristic of the invention are set forth in the appended claims. The

5   invention itself, however, as well as a preferred mode of use, further objectives and advantages thereof, will best be understood by reference to the following detailed description of an illustrative embodiment when read in conjunction with the accompanying drawings, wherein:

10   **Figure 1** is an exemplary block diagram illustrating a network data processing system according to one embodiment of the present invention;

Figure 2 is an exemplary block diagram illustrating a server device according to one embodiment of the

15   present invention;

Figure 3 is an exemplary block diagram illustrating a client device according to one embodiment of the present invention;

Figure 4 is an exemplary block diagram illustrating

20   data flow according to one embodiment of the present invention;

Figures 5A and **5B** are diagrams illustrating an example modification of a temporal parameter of computer program data according to one embodiment of the present

25   invention; and

Figure 6 is a flowchart outlining an exemplary operation of one embodiment of the present invention.

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DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference now to the figures, **Figure 1** depicts a
pictorial representation of a network of data processing

5   systems in which the present invention may be implemented.
Network data processing system **100** is a network of
computers in which the present invention may be
implemented. Network data processing system **100** contains
a network **102**, which is the medium used to provide

10   communications links between various devices and computers
connected together within network data processing system
100. Network **102** may include connections, such as wire,
wireless communication links, or fiber optic cables.
In the depicted example, a server **104** is connected to

15   network **102** along with storage unit **106**. In addition,
clients **108**, **110**, and **112** also are connected to network
102. These clients **108**, **110**, and **112** may be, for example,
personal computers or network computers. In the depicted
example, server **104** provides data, such as boot files,

20   operating system images, and applications to clients
108-112. Clients **108**, **110**, and **112** are clients to server
104. Network data processing system **100** may include
additional servers, clients, and other devices not shown.
Transcoding proxy server **114** is a proxy for the

25   client **108**. The transcoding proxy server **114** receives
requests and data from the client device **108** as well as
data destined for the client device **108**. The transcoding
proxy server **114** may reformat data destined for the client
device **108** in accordance with a user profile stored on the

30   transcoding proxy server **114** as well as perform other
processing on the received data. The other processing

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performed by the transcoding proxy server **114** may include
processing associated with a firewall application or the
like, as is generally known in the art.

　　　　In the depicted example, network data processing
5　system **100** is the Internet with network **102** representing a
worldwide collection of networks and gateways that use the
TCP/IP suite of protocols to communicate with one another.
At the heart of the Internet is a backbone of high-speed
data communication lines between major nodes or host
10　computers, consisting of thousands of commercial,
government, educational and other computer systems that
route data and messages. Of course, network data
processing system **100** also may be implemented as a number
of different types of networks, such as for example, an
15　intranet, a local area network (LAN), or a wide area
network (WAN). **Figure 1** is intended as an example, and not
as an architectural limitation for the present invention.

　　　　The present invention provides a mechanism by which
temporal parameters of computer program data are
20　identified and their values modified to accommodate a
disability of a user. What is meant by "computer program
data" is any input that is received which is interpreted
by a computer to perform a function. For example, the
computer program data may be code for generating a web
25　document, conventional computer program code (source,
executable or machine), Java bytecode, or the like. For
purposes of illustration, the following exemplary
embodiments of the present invention will assume that the
computer program data is a HyperText Markup Language
30　(HTML) document that is used, in a manner generally known
in the art, by a web browser application to generate a web
page output on a client device.

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The present invention may be implemented entirely within a client device, such as client **108**, or may be distributed between the client device and a server device, such as transcoding proxy server **114**. If implemented

5   entirely on the client device, the present invention may be implemented as a software application on the client device, as a part of a web browser application, as a plug-in component to a web browser application, or the like. Alternatively, the present invention may be

10   implemented in hardware, or a combination of hardware and software, on either the client device or a server device.

In a preferred embodiment, to be described in more detail hereafter, the present invention is implemented on a transcoding proxy server. Thus, with the preferred

15   embodiment of the present invention, a user of a client device may initiate a request for content, such as a web page document, using a web browser application resident on the client device **108**. The request is received by the transcoding proxy server **114** and forwarded to an

20   appropriate server **104** via the network **102**. The appropriate server **104** may be determined, as is generally known in the art, based on header information in the data packets of the request.

The server **104** receives the request for content from

25   the client device **108** and responds with the requested content, such as a web page document. The requested content may include one or more temporal parameters, such as a refresh rate, frame rate, animated GIF timing intervals, banner scroll rates, and the like. The

30   requested content is transmitted by the server **104** to the client device **108** via the network **102**.

The requested content is received by the transcoding

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proxy server **114** which then searches the requested content
for predefined temporal parameters. The predefined
temporal parameters are defined in a user profile stored
in the transcoding proxy server **114**. The user profile is
5   retrieved when the requested content is received, based on
client device address information stored in the header of
the data packets of the requested content. The user
profile identifies the temporal parameters for which the
transcoding proxy server **114** is to search as well as the
10   modified values for these temporal parameters.

The modified values are values that provide
sufficient time, when the requested content is output, so
that the user may receive the requested content and
interpret the requested content. For example, the
15   temporal parameter may be a refresh rate of a web page
document banner advertisement. In such a case, if a user
has diminished cognitive capacity, the refresh rate may be
set to a longer time interval so that the user is provided
with extra time in which to view and interpret the banner
20   advertisement.

Based on the user profile stored on the transcoding
proxy server **114**, the transcoding proxy server **114**
searches the requested content for the predefined temporal
parameters and modifies the values for these temporal
25   parameters as they are encountered. The values for the
temporal parameters are modified to be the values set
forth in the user profile. The modified requested content
is then transmitted to the client device **108**. In the case
of a web page document, when the client device **108**
30   receives the requested content, the web browser
application on the client device receives the web page
document including the modified temporal parameters, and

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outputs the web page document using a web browser
application, in a manner generally known in the art.

Thus, the present invention provides a mechanism by
which temporal parameters associated with requested
5   content, i.e. computer program data, may be modified to
accommodate disabled users. The present invention may be
implemented on either a server or a client device. A
server implementation is chosen as a preferred embodiment
due to the ease of distributing and updating the present
10   invention using servers rather than distributing the
present invention to each individual client device.
However, the distribution of the present invention to each
individual client device is well within the scope of the
present invention.

15   Referring to **Figure 2,** a block diagram of a data
processing system that may be implemented as a server,
such as server **104** or transcoding proxy server **114** in
Figure 1, is depicted in accordance with a preferred
embodiment of the present invention. Data processing
20   system **200** may be a symmetric multiprocessor (SMP) system
including a plurality of processors **202** and **204** connected
to system bus **206.** Alternatively, a single processor
system may be employed. Also connected to system bus **206**
is memory controller/cache **208,** which provides an
25   interface to local memory **209.** I/O bus bridge **210** is
connected to system bus **206** and provides an interface to
I/O bus **212.** Memory controller/cache **208** and I/O bus
bridge **210** may be integrated as depicted.

Peripheral component interconnect (PCI) bus bridge
30   **214** connected to I/O bus **212** provides an interface to PCI
local bus **216.** A number of modems may be connected to PCI
bus **216.** Typical PCI bus implementations will support

four PCI expansion slots or add-in connectors.
Communications links to network computers **108-112** in
Figure 1 may be provided through modem **218** and network
adapter **220** connected to PCI local bus **216** through add-in

5   boards.

Additional PCI bus bridges **222** and **224** provide
interfaces for additional PCI buses **226** and **228**, from
which additional modems or network adapters may be
supported. In this manner, data processing system **200**

10   allows connections to multiple network computers. A
memory-mapped graphics adapter **230** and hard disk **232** may
also be connected to I/O bus **212** as depicted, either
directly or indirectly.

Those of ordinary skill in the art will appreciate

15   that the hardware depicted in **Figure 2** may vary. For
example, other peripheral devices, such as optical disk
drives and the like, also may be used in addition to or in
place of the hardware depicted. The depicted example is
not meant to imply architectural limitations with respect

20   to the present invention.

The data processing system depicted in **Figure 2** may
be, for example, an IBM RISC/System 6000 system, a product
of International Business Machines Corporation in Armonk,
New York, running the Advanced Interactive Executive (AIX)

25   operating system.

As mentioned above, the server device depicted in
Figure 2 may be used as a transcoding proxy server, such
as transcoding proxy server **114** in **Figure 1**. As a
transcoding proxy server, the processor **202** or **204**

30   receives a request for content from a client device via
modem **218** or network adapter **220**. The processor **202**, for
example, performs any necessary processing on the request

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for content and then forwards the request to the network
102 via the network adapter 220.

The request for content is then routed through the
network 102, from computing device to computing device,
5   based on address information included in the header of
data packets of the request for content. The request for
content eventually arrives at the content server 104 which
performs the necessary processing on the request, as is
generally known in the art, and responds to the request
10   with the requested content.

The requested content is routed back to the
transcoding proxy server via the network 102 based on
address information stored in headers of the data packets
of the requested content. The processor 202, for example,
15   of the transcoding proxy server receives the requested
content via the network adapter 220. The processor 202
performs processing on the requested content and then
forwards the requested content to the client device via
one of the modem 218 or the network adapter 220.

20   The processing performed on the requested content
includes a search for predefined temporal parameters and
replacement of the values of these predefined temporal
parameters. Such processing includes retrieval of a user
profile from local memory 209 based on client device
25   identification information received in the header of the
request for content. The user profile defines the
temporal parameters that are to be searched for in
requested content for this user as well as the preferred
values for these temporal parameters.

30   Based on the user profile, the processor 202 searches
the requested content for the identified temporal
parameters in the user profile and replaces the values in

the requested content for these temporal parameters with the preferred values in the user profile. The modified requested content is then forwarded to the client device via one of the modem **218** or the network adapter **220**. In

5   this way, the transcoding proxy server modifies requested content to take into consideration the cognitive disabilities of the user requesting the content.

With reference now to **Figure 3**, a block diagram illustrating a data processing system is depicted in which

10 the present invention may be implemented. Data processing system **300** is an example of a client computer. Data processing system **300** employs a peripheral component interconnect (PCI) local bus architecture. Although the depicted example employs a PCI bus, other bus

15 architectures such as Accelerated Graphics Port (AGP) and Industry Standard Architecture (ISA) may be used. Processor **302** and main memory **304** are connected to PCI local bus **306** through PCI bridge **308**. PCI bridge **308** also may include an integrated memory controller and cache

20 memory for processor **302**. Additional connections to PCI local bus **306** may be made through direct component interconnection or through add-in boards.

In the depicted example, local area network (LAN) adapter **310**, SCSI host bus adapter **312**, and expansion bus

25 interface **314** are connected to PCI local bus **306** by direct component connection. In contrast, audio adapter **316**, graphics adapter **318**, and audio/video adapter **319** are connected to PCI local bus **306** by add-in boards inserted into expansion slots. Expansion bus interface **314**

30 provides a connection for a keyboard and mouse adapter **320**, modem **322**, and additional memory **324**. Small computer system interface (SCSI) host bus adapter **312** provides a

connection for hard disk drive **326,** tape drive **328,** and CD-ROM drive **330.** Typical PCI local bus implementations will support three or four PCI expansion slots or add-in connectors.

5   An operating system runs on processor **302** and is used to coordinate and provide control of various components within data processing system **300** in **Figure 3.** The operating system may be a commercially available operating system, such as Windows 2000, which is available from

10   Microsoft Corporation. An object oriented programming system such as Java may run in conjunction with the operating system and provide calls to the operating system from Java programs or applications executing on data processing system **300.** "Java" is a trademark of Sun

15   Microsystems, Inc. Instructions for the operating system, the object-oriented operating system, and applications or programs are located on storage devices, such as hard disk drive **326,** and may be loaded into main memory **304** for execution by processor **302.**

20   Those of ordinary skill in the art will appreciate that the hardware in **Figure 3** may vary depending on the implementation. Other internal hardware or peripheral devices, such as flash ROM (or equivalent nonvolatile memory) or optical disk drives and the like, may be used

25   in addition to or in place of the hardware depicted in **Figure 3.** Also, the processes of the present invention may be applied to a multiprocessor data processing system.

As another example, data processing system **300** may

30   be a stand-alone system configured to be bootable without relying on some type of network communication interface, whether or not data processing system **300** comprises some

type of network communication interface. As a further
example, data processing system **300** may be a Personal
Digital Assistant (PDA) device, which is configured with
ROM and/or flash ROM in order to provide non-volatile
5   memory for storing operating system files and/or
user-generated data.

The depicted example in **Figure 3** and above-described
examples are not meant to imply architectural
limitations. For example, data processing system **300**
10 also may be a notebook computer or hand held computer in
addition to taking the form of a PDA. Data processing
system **300** also may be a kiosk or a Web appliance.

The client device depicted in **Figure 3** may be used
to send requests for content and receive requested
15 content using a web browser application in a manner
generally known in the art. The requested content that
is received may be modified by a transcoding proxy server
from that sent by the content server, as described above.

Alternatively, the functions described above as
20 being performed by the transcoding proxy server may be
implemented in the client device itself. For example,
the searching for temporal parameters in the requested
content and replacement of the values of the identified
temporal parameters may be performed by a temporal
25 parameter adjustment application resident on the client
device. The temporal parameter adjustment application
may be a stand alone application, a portion of a web
browser application, a plug-in application to a web
browser application, or the like. With such an
30 embodiment, the user profile described above may be
stored on the client device so that it is readily
retrievable by the temporal parameter adjustment

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application.

Figure 4 provides an exemplary block diagram to
illustrate the data flow between the client device,
transcoding proxy server, and the content server in

5   accordance with a preferred embodiment of the present
invention. The preferred embodiment assumes, for
illustration purposes, that the client device sends a
request for a HyperText Markup Language (HTML) document,
although the present invention is not limited to such

10   requested content. As shown in Figure 4, the client
device 410 generates and transmits a document request 415
to the transcoding proxy server 430. The transcoding
proxy server 430 performs any necessary processing on the
document request 415 and forwards the request to the

15   content server 420. The content server 420 responds to
the document request by transmitting the requested
document 425 to the transcoding proxy server 430. The
requested document 425 sent from the content server 420
contains a temporal parameter 428.

20   The transcoding proxy server 430 receives the
requested document 425 with the temporal parameter 428
and searches the requested document 425 for the temporal
parameter 428. The transcoding proxy server 430, having
found the temporal parameter 428, replaces the value for

25   the temporal parameter 428 with a value designated in a
user profile for the user of the client device 410. The
resulting document 435 contains a modified temporal
parameter 438. The resulting document 435 is transmitted
to the client device 410. Thus, the resulting document

30   435 contains the same content as the document 425
transmitted by the content server 420 only with a

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modified temporal parameter **438**.

Figures **5A** and **5B** illustrate an example of the use of the present invention with a requested HTML document. Figure **5A** represents an HTML document as it is

5 transmitted by the content server. As shown in **Figure 5A,** the HTML document includes a HyperText Transfer Protocol (HTTP) refresh parameter **510** that has a value **515** set to a value of five seconds. As is generally known in the art, HTTP refresh rates are used to

10 automatically refresh the content of a web page after a given time interval. In this way, a web page's content may be dynamically modified by a supplier of the web page or the content may be modified by referencing content from another web location.

15 HTTP refresh rates are typically chosen to be between one and five seconds for non-disabled users by many programmers. Thus, the five second refresh rate in the HTML document of **Figure 5A** may not be sufficient for a user that suffers from a cognitive disability.

20 As described above, the present invention provides a mechanism by which a cognitively disabled user may have the temporal parameters of requested content modified to take into consideration the disability of the user. The resulting HTML document is shown in **Figure 5B.** As shown

25 in **Figure 5B,** the value **520** for the HTTP refresh parameter **510** has been modified to ten seconds. Thus, a cognitively disabled user is provided with twice as much time between refreshes of the web page to interpret the information being displayed.

30 It has been stated above that the user profile includes a preferred value for the predetermined temporal parameters. The preferred value may be the actual value

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to which the temporal parameter should be set.
Alternatively, the preferred value may be a multiplier
for multiplying the original value for the temporal
parameter. For example, the preferred value in the
5   examples shown in **Figures 5A** and **5B** may be the actual
value of "10" or it may be a multiplier, such as "2".   In
even more complex embodiments of the present invention,
mathematical functions may be provided for calculating
the modified value for the temporal parameter based on
10   the original value for the temporal parameter as well as
other parameters, based on the particular implementation
selected.

    Other mechanisms for modifying the temporal
parameter values may be used without departing from the
15   spirit and scope of the present invention. For example,
the user of the client device may register with a
transcoding proxy server, or with the client device, to
thereby establish a user profile on the transcoding proxy
server. During the process of registering, the user may
20   provide information identifying the user's disability.
The user profile may include only an indicator of the
user's disability rather than a list of the temporal
parameters and their associated preferred values. Based
on the user's disability, the present invention may
25   determine which temporal parameters should be searched
for and their values adjusted as well as the modified
values for these temporal parameters.

    For example, the user may register with the
transcoding proxy server and indicate that the user is 76
30   years old. Thus, due to the user's advanced age, the
user may require additional time to interpret information
provided to the user. Accordingly, the present invention
may determine that the HTTP refresh time interval should

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be multiplied by 2, the banner scroll rate should be one
half that of the original banner scroll rate, and the
animated GIF timing intervals should be 7 seconds.
Alternatively, the user may indicate that he/she has mild
5   retardation. Accordingly, the present invention may
determine that the HTTP refresh time interval should be
multiplied by 3, the banner scroll rate should be one
third that of the original banner scroll rate, and the
animated GIF timing intervals should not be changed.

10   The determination of which temporal parameters to
search for and modify, as well as the modified values for
these temporal parameters, may be based on empirical
data, for example. Moreover, the present invention may
employ a neural network, expert system, rule-based
15   system, or the like, to make the determination of which
temporal parameters to search for and modify as well as
the modified values for these temporal parameters.

The above embodiments of the present invention have
been described in terms of a web browser application
20   retrieving web page content from a content server.
However, the present invention is not limited to such
embodiments. Rather, the present invention may be
applied to any computer program data that may include
temporal parameters. The computer program data may be
25   obtained from another computing device, such as a server,
or may be resident in a local storage device, for
example.

Thus, the present invention may be embodied as an
application on a client device that is executed on
30   computer program data to adjust the temporal parameters
in the computer program data in view of the disability of
the user. The present invention is not limited to any
particular computer language and may be applied to Java

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code, C++, HTML, Wireless Device Markup Language (WDML), and the like.

Figure 6 is a flowchart outlining an exemplary operation of the present invention. The operation shown

5   in Figure 6 may be performed in a transcoding proxy server or in a client device. As shown in Figure 6, the operation starts with receiving computer program data (step 610). The user profile is retrieved (step 620). A search of the computer program data for the predefined

10 temporal parameters is performed (step 630). The values for the identified temporal parameters are then modified in the computer program data based on the preferred values set forth in, or calculated based on, the user profile (step 640). The modified computer program data

15 is then output (step 650) and the operation ends.

Thus, the present invention provides a mechanism for adjusting temporal parameters in computer program data to take into consideration the disabilities of a user. In this way, a user that may have diminished cognitive

20 capacity may be provided with additional time with which to interpret information provided to him/her by the computer program data.

It is important to note that while the present invention has been described in the context of a fully

25 functioning data processing system, those of ordinary skill in the art will appreciate that the processes of the present invention are capable of being distributed in the form of a computer readable medium of instructions and a variety of forms and that the present invention

30 applies equally regardless of the particular type of signal bearing media actually used to carry out the distribution. Examples of computer readable media

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include recordable-type media, such as a floppy disk, a
hard disk drive, a RAM, CD-ROMs, DVD-ROMs, and
transmission-type media, such as digital and analog
communications links, wired or wireless communications
5   links using transmission forms, such as, for example,
radio frequency and light wave transmissions. The
computer readable media may take the form of coded
formats that are decoded for actual use in a particular
data processing system.

10   The description of the present invention has been
presented for purposes of illustration and description,
and is not intended to be exhaustive or limited to the
invention in the form disclosed. Many modifications and
variations will be apparent to those of ordinary skill in
15   the art. The embodiment was chosen and described in
order to best explain the principles of the invention,
the practical application, and to enable others of
ordinary skill in the art to understand the invention for
various embodiments with various modifications as are
20   suited to the particular use contemplated.